### *2.3.5 Downstream Snake River (RM 247 to 188):*

The Downstream Snake River segment (RM 247 to 188) includes the Snake River from below Hells Canyon Dam to immediately upstream of the Salmon River inflow (Figure 2.3.30). This segment is a rapid flowing, narrow river characterized by high, steep canyon walls and stretches of white water. The flow and volume of this segment are almost completely driven by the outflow of the Hells Canyon Complex reservoirs and support significant recreational uses year round.

**Photo 2.3.5. The mainstem Snake River downstream of the Hells Canyon Dam site (RM 247), circa 1939 to 1940, relatively low water years.** Photo from the collection of Dr. Lyle M. Stanford.

#### 2.3.5.1 INTRODUCTION

For a discussion on the effect of impoundments within the SR-HC TMDL reach see Section 2.1.1.4

While most of the processes discussed in Section 2.1.1.4 can result in reduced water quality, impoundments can also act to improve water quality in downstream segments. Brownlee

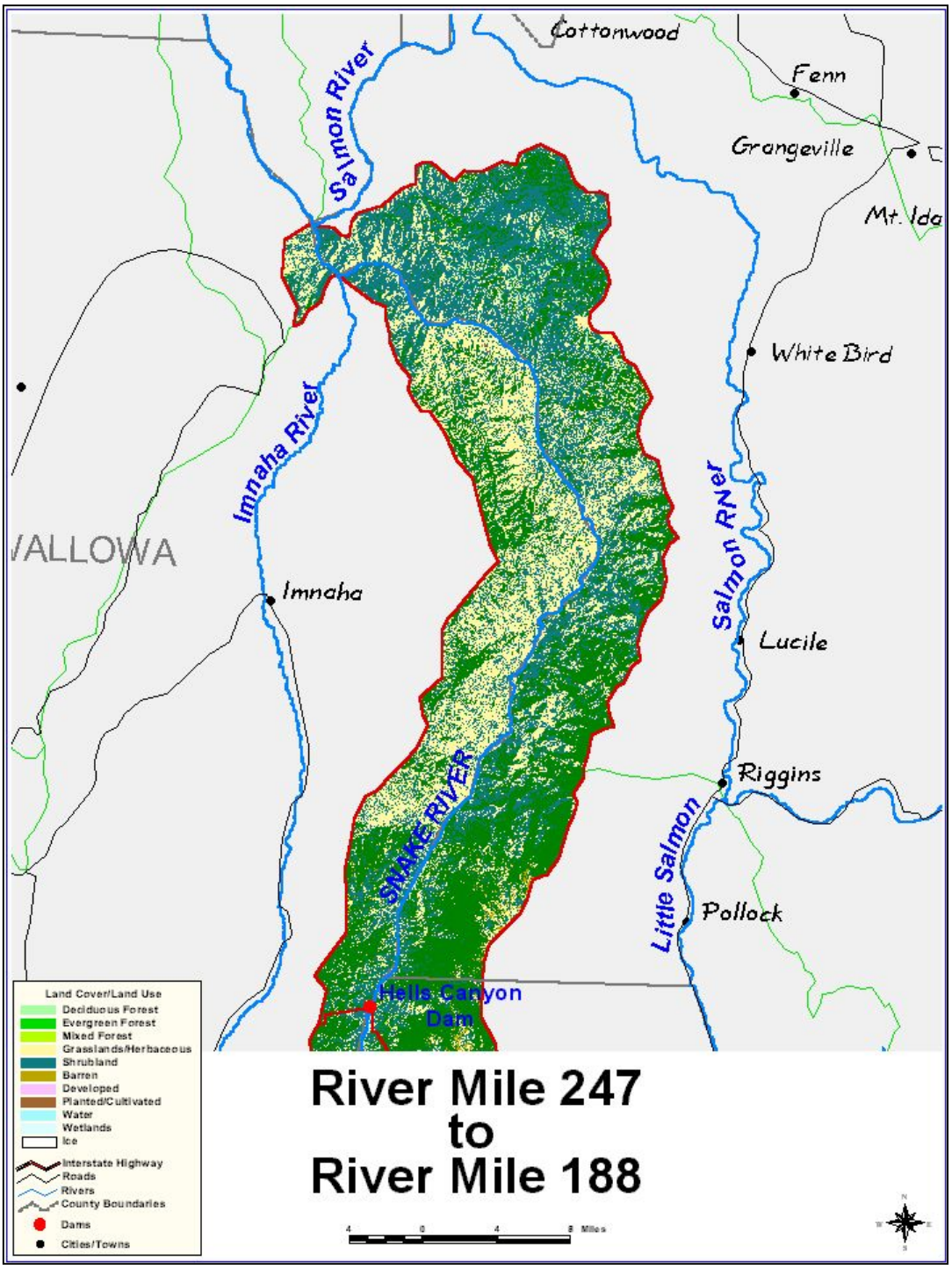


**Figure 2.3.30. The Downstream Snake River segment (RM 247 to 188) of the Snake River – Hells Canyon TMDL reach.**

Reservoir, located in the farthest upstream position in the Hells Canyon Complex, acts as a sink for both sediment and nutrients within the Hells Canyon Complex and downstream river segments; deep-water releases also act to lower water temperatures in downstream segments. To a lesser degree, Hells Canyon Reservoir acts in this same capacity and reduces sediment and attached pollutants that might otherwise enter downstream segments. While these changes in transport act to improve some aspects of water quality in the Downstream Snake River segment (RM 247 to 188), the agencies prefer to prevent the initial pollutant loading into a water system than to depend on instream treatment systems (ODEQ, 1999).

The Imnaha River (inflow at RM 191.6) represents less than 3 percent of the average total downstream Snake River system flow and drains approximately 622 square miles of land in eastern Oregon. Land use is primarily forested and agricultural, with pastureland grazing being the predominant practice. A TMDL for the Imnaha Basin in Oregon targeting temperature was completed in 2001. Flow patterns within the Imnaha drainage are seasonal in nature. Increasing during spring runoff (usually extending from late February to early April) when mountain snows melt and spring rains increase secondary tributary flows (maximum of 20,200 cfs in January 1997). Irrigation needs and dryer summer weather patterns significantly reduce summer and fall flows. These flows are often less than 7 percent of those observed during the spring melt (minimum of 16 cfs in November of 1931). Average flows vary from 1,930 cfs during spring runoff to an average of 44 cfs during the late summer season (annual averages compiled from 1929 to 1999 USGS flow data from the gauge #13292000). Please note: This gauge station is the only one available for the mainstem Imnaha River with a consistent database for the period of record. While the relative differences in flow from this station are useful in interpreting overall seasonal trends for this system, it is located some distance upstream from the mouth of the Imnaha River. As such, it does not necessarily reflect the total annual average flows at the discharge to the mainstem Snake River.

#### 2.3.5.2 WATER QUALITY CONCERNS/STATUS

*General Information*

The waters in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach are listed as water quality limited for mercury and elevated temperatures (Table 2.3.36). A detailed examination of the data available to this assessment has identified that no water column mercury data exists so it is not possible to assess compliance with the SR-HC TMDL mercury target. However a fish consumption advisory for mercury is currently in place for the State of Oregon and therefore the designated use of fishing is not fully supported. Elevated water temperatures in excess of the salmonid spawning and salmonid rearing/cold water aquatic life have been observed to occur in this segment. Both the pollutants and their potential affects on this segment of the SR-HC TMDL reach are described in more detail in the following sections.

*Listed Pollutants and Designated Beneficial Uses*

Table 2.3.36 summarizes the listed pollutants and designated beneficial uses for the Downstream Snake River segment (RM 247 to 188). A more detailed description of each of the designated beneficial uses is included in Section 2.2.2. A more detailed description of the listed pollutants and the assessment process is located in Section 3.0 through 3.7.

**Table 2.3.36 Listing information for the Downstream Snake River segment (RM 247 to 188) of the Snake River - Hells Canyon TMDL reach.**

| Segment | Idaho Listed Pollutants | Idaho Designated Beneficial Uses |
|---|---|---|
| Snake River: RM 247 to 188<br>Downstream Snake River<br>(Hells Canyon Dam to<br>Salmon River Inflow) | Temperature | Cold water aquatic life<br>salmonid spawning<br>primary contact recreation<br>domestic water supply<br>special resource water |
| **Segment** | **Oregon Listed Pollutants** | **Oregon Designated Beneficial Uses** |
| Snake River: RM 260 to 188<br>Lower half of Hells Canyon Reservoir<br>Downstream Snake River<br><br>(Grande Ronde Basin) | Mercury, temperature | Public/private domestic water supply<br>industrial water supply<br>irrigation water, livestock watering<br>salmonid rearing and spawning<br>resident fish and aquatic life<br>water contact recreation<br>wildlife and hunting<br>fishing, boating, aesthetics<br>anadromous fish passage<br><br>(For notes on absence of hydropower see section 2.2.2)<br>commercial navigation and transport |

Salmonid spawning and rearing, and cold water aquatic life and resident fish are designated as beneficial uses in this segment. The salmonid species in this segment include bull, steelhead, and rainbow trout as well as fall and spring/summer chinook. The general spawning and incubation periods for the salmonid species are the following:

bull trout - September 01 to April 01 (upper tributaries only)
rainbow trout – March 01 to July 15 (tributaries only)
steelhead trout - February 01 to July 15 (tributaries only)
redband trout – March 01 to July 15 (tributaries only)

spring chinook – August 01 to April 01 (tributaries only)
summer chinook - August 15 to June 15 (tributaries only)
fall chinook – October 23 to April 15 (mainstem spawning)
mountain whitefish – November 01 to March 30 (mainstem spawning)

Of the salmonid species present, only fall chinook and mountain whitefish spawn in the mainstem Snake River within this segment of the SR-HC TMDL reach. Steelhead and rainbow trout and spring/summer chinook can spawn in the mouths of tributaries but are more likely to spawn further up the tributaries. Bull trout spawn only in the upper tributary reaches. Therefore the salmonid spawning criteria will apply in the mainstem during the fall chinook spawning period (October 23 to April 15) and the mountain whitefish spawning period (November 01 to March 30). The resident fish include such cool and warm water fish as bass, crappie, and catfish. In addition there is a population of white sturgeon in the Downstream Snake River segment (RM 247 to 188). In this segment of the river cold water fish form the dominant community.

*Summary and Analysis of Existing Water Quality Data*

***Mercury.***
The Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach is listed as water quality limited due to a human fish consumption advisory for mercury from the State of Oregon.

General Concerns. See Section 2.2.4.2.

Water Quality Targets. See Section 2.2.4.2 and Table 2.2.2.

Common Sources. See Section 2.2.4.2. The majority of mercury loading to the Downstream Snake River segment (RM 247 to 188) is from mercury processed through Hells Canyon Complex.

Historical Data. There are no known historical mercury data available in either an anecdotal or numeric format for this segment.

Current Data. The 1986 and 1988 Water Quality Status reports for the State of Idaho (IDEQ, 1986 and 1988a), using a WQI rating for the Snake River below Hells Canyon Dam, shows that metal toxicity levels in this segment had a "good" rating in 1986 and a "fair" rating in 1988. The overall station conditions for all evaluated pollutants were judged to be "fair" in both years. As outlined in Table 2.3.37, mercury levels have been monitored in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach on a limited basis. The data collection and analysis occurred in 1997 (Clark and Maret, 1998). However these data do not include water column data.

**Table 2.3.37 Mercury monitoring for the Downstream Snake River segment (RM 247 to 188) of the Snake River - Hells Canyon TMDL reach.**

| Segment | Mercury Monitoring Dates | Source |
|---|---|---|
| Hells Canyon Dam to Salmon River Inflow (RM 247 to 188) | Aug 1997 | Clark and Maret, 1998 (USGS) |

Segment Status. All but one of the mercury samples applicable to the Downstream Snake River segment are from studies conducted in upstream waters. The one sample included only two fish tissue samples, therefore some interpolations of transport have been made. The following facts and assumptions were applied in the interpolation process.

- The outflow from Brownlee Reservoir represents the predominant source of water for Oxbow and Hells Canyon Reservoirs (greater than 99%).
- Outflow from Hells Canyon Reservoir represents the majority of the water for the Downstream Snake River segment (RM 247 to 188).
- The majority of sediments delivered to Oxbow and Hells Canyon Reservoirs come from the Brownlee Reservoir outflow.

- Due to the depositional nature of Brownlee Reservoir the sediments carried in the outflow are heavily weighted toward smaller, finely divided particles and organic matter. Further, but limited, retention of all but extremely small particle sizes occurs in Oxbow and Hells Canyon Reservoirs.
- These smaller particles and associated organic matter represent a substantial adsorption and transport pathway potential for mercury from Brownlee into the lower reservoirs and on into the Downstream Snake River segment (RM 247 to 188).
- Because there are no other significant inflows to this segment known to contain natural geologic or substantial legacy mining mercury activities, the major source of mercury in the Downstream Snake River segment is assumed to be Brownlee Reservoir and upstream tributary inflows.

Therefore, mercury concentrations in the Downstream Snake River segment (RM 247 to 188) are not expected to exceed those observed in the Hells Canyon Reservoir, Oxbow Reservoir, Brownlee Reservoir, or the Upstream Snake River segment (RM 409 to 335). In a conservative assessment, mercury concentrations in the Downstream Snake River segment (RM 247 to 188) can be assumed to be less than or equal to those observed in Brownlee Reservoir.

The one data point available in this segment of the SR-HC TMDL reach, an average of two samples collected in 1997, shows mercury levels at 0.15 mg/kg dry weight fish tissue. This is below the level used by the Oregon Division of Health to establish a mercury fish tissue advisory. It is also below the new US EPA guidance criteria for mercury in fish tissues (US EPA, 2001a, 2001b, 2001c).

Upstream data show impairment of the designated beneficial use of fishing. Available upstream data and information demonstrate a high level of concern for the wildlife and hunting designated beneficial use due to observed fish tissue methylmercury concentrations. Collection of water column data is required to determine the status of cold water aquatic life, salmonid rearing, resident fish and aquatic life, domestic water supply designated beneficial uses.

***Temperature.***
The Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach is listed for temperature due to violations of the Oregon and Idaho water quality standards, including numeric and narrative temperature criteria for cold water aquatic life, resident fish and aquatic life, and salmonid spawning and rearing.

General Concerns. See section 2.2.4.6.

Water Quality Targets. See Section 2.2.4.6 and Table 2.2.2.

Common Sources. See Section 2.2.4.6.

Historical Data. Data collected roughly monthly from 1969 to 1974 by the US EPA in the Downstream Snake River segment at RM 247 (below Hells Canyon Dam) show temperatures ranging from 2 $^{o}$C in January and February, 1972 (air temperature at 6.5 $^{o}$C and 7.5 $^{oC}$ respectively) to 22 $^{o}$C in August, 1970 and 1972 (air temperature at 32 $^{o}$C). When compared to

the 13 $^{o}$C maximum weekly maximum temperature target identified by the SR-HC TMDL for salmonid spawning in interstate waters (because these are instantaneous data, there is no way to determine an average daily temperature) the data show that the target was routinely exceeded in September (100%) and October (57%). Roughly 26 percent of all available data show temperatures above the salmonid rearing/cold water aquatic life temperature target of 17.8 $^{o}$C (all occurring during late July, August or September). The data set contained 54 data points. These data were collected over a variety of seasonal variations, but do not represent continuous monitoring (US EPA, 1974a, 1975, 1998a).

Current Data. Data collected roughly monthly from 1975 to 1991 by the US EPA in the Downstream Snake River segment at RM 247 (below Hells Canyon Dam) show temperatures ranging from 1 $^{o}$C in January, 1979 and 1985 (air temperature at -4.5 $^{o}$C and 2 $^{o}$C respectively) to 24 $^{o}$C in July, 1975 and September, 1987 (air temperature at 35 $^{o}$C and 30 $^{o}$C respectively) (Figure 2.3.31 a and b). When compared to the 13 $^{o}$C maximum weekly maximum temperature target identified by the SR-HC TMDL for salmonid spawning in interstate waters (because these are instantaneous data, there is no way to determine an average) the data show that the target was routinely not met during September (82%) and October (47%). Targets were not met in November only 7 percent of the time. Roughly 22 percent of all available data show temperatures above the salmonid rearing/cold water aquatic life temperature target of 17.8 $^{o}$C (all occurring during late July, August or September). This set contained 148 data points. These data were collected over a variety of seasonal variations, but do not represent continuous monitoring (US EPA, 1975, 1998a).

**Table 2.3.38 Temperature monitoring information for the Downstream Snake River segment (RM 247 to 188) of the Snake River - Hells Canyon TMDL reach.**

| Segment | Temperature Monitoring Dates | Source |
|---|---|---|
| Hells Canyon Dam to Salmon River Inflow (RM 247 to 188) | Summer sampling 1980 to 1992<br>1968 to 1992 | USGS data<br>US EPA STORET data, 1998a |

The 1986 and 1988 Water Quality Status reports for the State of Idaho (IDEQ, 1986 and 1988a), using a WQI rating for the Snake River below Hells Canyon Dam, show that temperature levels in this segment had a “good” rating both years while the overall station conditions for all evaluated pollutants were judged to be “fair” in both years. Current temperature data available for the Downstream Snake River segment (RM 247 to 188) include monitoring of both inflow and mainstem values (Figures 2.3.31 a and b). Water temperature data for some areas of the drainage extend back to the 1960’s and represent a variety of high and low annual precipitation levels. Daily maximum, mean and minimum water temperatures are recorded in some areas of the Downstream Snake River segment, but collection frequency and period of record varies.

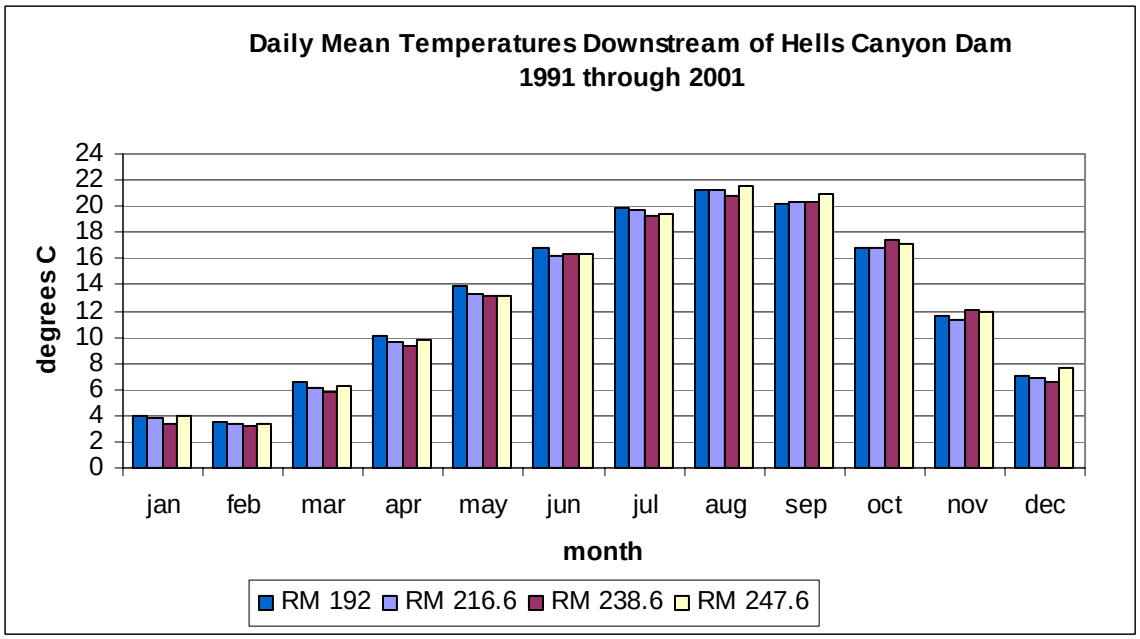


**Figure 2.3.31a Mean water temperatures for the Downstream Snake River segment (RM 247 to 188) of the Snake River - Hells Canyon TMDL reach.**

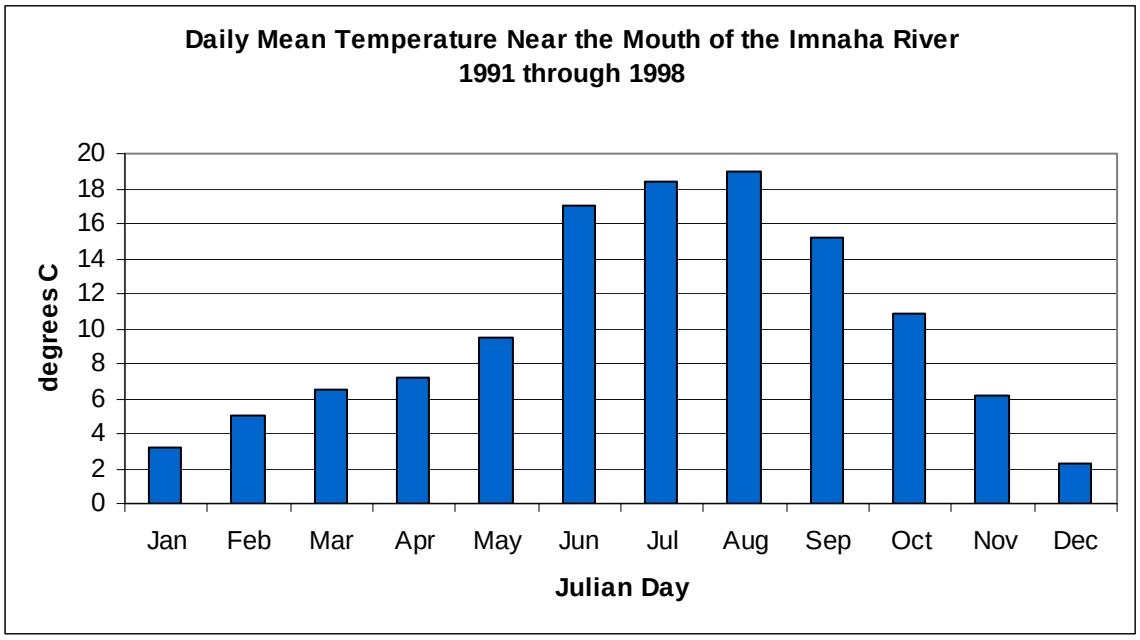


**Figure 2.3.31b Mean water temperatures for the mouth of the Imnaha River at the inflow to the Downstream Snake River segment (RM 247 to 188) of the Snake River - Hells Canyon TMDL reach.**

Segment Status. The primary source of water inflowing to the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach is Hells Canyon Reservoir, immediately upstream (more than 95% of the total inflow). Figure 2.3.31a and b show that the average summer temperature of inflowing water to be 20 $^{o}$C (68 $^{o}$F). The average winter season temperature of inflowing water is approximately 6$^{o}$ C (43 $^{o}$F). Due to the high, narrow canyon walls that provide a high degree of shading, the temperature of water moving downstream of Hells Canyon Dam does not increase rapidly. As there are relatively few anthropogenic sources of elevated temperature in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach, temperature increases within the segment are most likely due to solar radiation and high summer air temperatures, and the influence of upstream sources. Daily maximum and minimum water temperatures show a wider overall range and greater total variation as distance downstream from Hells Canyon Dam increases. Temperature changes from the outlet of Hells Canyon Dam (RM 247) to the inflow of the Salmon River at RM 188 generally average 3 $^{o}$C (5.4 $^{o}$F) during the summer season. The average summer temperature of inflowing water from the Salmon River is 20 $^{o}$C (68 $^{o}$F). The average winter season temperature of inflowing water is approximately 7 $^{o}$C (45 $^{o}$F).

Available data show that exceedences of the salmonid rearing/cold water aquatic life target of 17.8 $^{o}$C occur during July, August and September. However, the magnitude of the observed exceedences is lower due to the effect of deep water releases from the Hells Canyon Complex upstream. Cold water aquatic life and salmonid rearing designated uses are supported in the Downstream Snake River segment (RM 247 to 188) due to this cooling effect and the presence of cold water refugia.

Available data show that exceedences of the salmonid spawning target of less than or equal to 13 $^{o}$C maximum weekly maximum temperature occur during the first days of the fall chinook spawning period (starting October 23). This exceedence is due in part to the temporal shift in water temperature caused by the Hells Canyon Complex Reservoirs. However, the level of impairment (if any) of fall chinook spawning resulting from this shift has yet to be determined.

***Total Dissolved Gas.***

General Concerns. See Section 2.2.4.7.

Water Quality Targets. See Section 2.2.4.7 and Table 2.2.2.

Common Sources. See Section 2.2.4.7.

Historical Data. There are no historical total dissolved gas data available.

Current Data. The current data available for total dissolved gas have been collected by IPCo. Spill tests were conducted at Hells Canyon Dam on June 3, 1998 at a spill level of 28,000 cfs. The total dissolved gas levels observed from spilling through the upper gates averaged 139 percent of saturation while spill through the lower gates averaged 135 percent of saturation.

Spill episodes at Hells Canyon Dam over 19,000 cfs caused exceedences of the less than 110 percent total dissolved gas target throughout the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL. Total dissolved gas levels did not drop below 110 percent upstream

of RM 188 at this level of discharge. Target exceedences from spill volumes between 9,000 cfs and 13,400 cfs were not observed downstream of RM 200, and spill volumes of 2,400 cfs showed target exceedences extending downstream to RM 230 only. During the period of no spill, the target of less than 110 percent of saturation within the Snake River below Hells Canyon Dam was always met. Total dissolved gas in the tailwater area of Hells Canyon Dam ranged from 108 percent to 136 percent while spill was occurring from Hells Canyon Dam. Nearly all levels of spill monitored resulted in total dissolved gas levels above the total dissolved gas target.

Segment Status. Spills from Hells Canyon Dam in excess of 2,000 to 3,000 cfs result in total dissolved gas levels exceeding the total dissolved gas target in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach (IPCo, 1998c, 1999b, 1999f).

Elevated total dissolved gas levels from spills through the Hells Canyon Complex reservoirs may be a significant factor in resident and anadromous fish survival both in the reservoirs and downstream in the Snake River. A study by IPCo determined that in general, spills in excess of 2,000 to 3,000 cfs result in total dissolved gas levels that exceed the state standard of less than 110 percent of saturation both within the reservoirs and downstream in the Snake River (IPCo, 1998c, 1999b, 1999f).

During the period of no spill, the state standard of less than 110 percent of saturation total dissolved gas within the Snake River below Hells Canyon Dam was always met (IPCo, 1999b).

#### 2.3.5.3 DATA GAPS

See Section 2.4

#### 2.3.5.4 POLLUTANT SOURCES

See Section 2.5

*Point Source*

There are no known permitted point sources that discharge directly to the Downstream Snake River segment (RM 247 to 188) outside of the permit for discharge from Hells Canyon Dam. This permit applies to miscellaneous discharge water only, not water released directly through the dam.

*Nonpoint Source*

Nonpoint sources discharging to the mainstem Snake River in the SR-HC TMDL reach include agricultural, recreational, urban/suburban, and forestry land use, as well as ground water and natural and background loading.

***Agricultural.***

A minor amount of the agricultural land (0.2%) within the SR-HC TMDL reach is located in the drainage area of the Imnaha River. This system flows into the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach. Agricultural practices within this drainage include dryland crops and pasture (grazing), only very limited use of irrigation is reported. Only very minimal agricultural return flows have been reported within this segment. Grazing occurs to some extent in areas of this segment but animal densities are minimal.

***Recreational.***

Even with its distance from populated urban areas, the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach is a popular recreational destination year-round, due to its proximity to other recreational opportunities within the Hells Canyon Complex, and the unique whitewater opportunities it represents. Water-based recreational activities peak in the summer season with heavy usage observed between Memorial Day weekend and Labor Day weekend, when the river is used by many boaters, swimmers, campers, whitewater rafters, jet-boat enthusiasts and anglers. Camping and bank-fishing use is also substantial (IPCo, 2000b; HCNRA, 1998a and 1998b, 1999a and 1999b).

***Urban/Suburban.***

A minor amount of the urban/suburban land within the SR-HC TMDL reach is located in the drainage areas of the Downstream Snake River segment (RM 247 to 188) and the inflowing Imnaha River drainage. Rural residential housing supported by septic systems is present within this segment but densities are quite minimal.

***Ground Water.***

Many natural springs and ground-water inflows have been observed in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach and the associated Imnaha River drainage. These inflows occur in the tributary drainages and the reservoir system, entering both above and below the water level in many locations. Subsurface recharge from irrigation water use is estimated to be minimal in the Downstream Snake River segment (RM 247 to 188) due to low irrigation water usage in this area. Natural ground-water inputs are estimated to dominate over subsurface recharge in most areas of this segment.

***Background and Natural Contributions.***

The natural sources discussed in Section 2.5 are known to be present to some degree in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach. However, the occurrence of natural sources of mercury is more prevalent in tributaries to the Upstream Snake River segment (RM 409 to 335) and the Brownlee Reservoir segment (RM 335 to 285) than in the Downstream Snake River segment (RM 247 to 188).

#### 2.3.5.5 POLLUTION CONTROL EFFORTS

See Section 2.6

*Other TMDL Efforts*

No TMDLs or watershed management plans are currently in place in the Downstream Snake River segment (RM 247 to 188) of the SR-HC TMDL reach with the exception of the Hells Canyon National Recreation Area Comprehensive Management plan amendment to the Wallowa-Whitman National Forest Plan (USDA-USFS, 1997), and the TMDL for temperature completed for the Imnaha River Basin by ODEQ (2001).

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